

# Remodeling Your Dairy—Cost Effective Facilities

Looking to the future, many Iowa dairy producers are remodeling operations to increase profitability, labor efficiency, better working conditions, add a family member or for other quality of life reasons.

As remodeling occurs, many producers are expanding as well. The majority of expansions are using a combination of existing and new facilities. These producers are favoring freestall barns and pit-parlor designs for very good reason.

Considerations for building new and remodeled facilities are many. Each producer has an individual decision to make because each farm is unique in its present facility situation and future goals for the dairy farm and family.

Proper planning prevents poor performance. That is very true in regards to remodeling dairy operations. Consult others who have remodeled and consider outside consultants to assist in planning the project.

**Labor Efficiency is Priority One!** If things don't flow, labor can be a time management problem. Identify and eliminate labor bottlenecks in the remodeled operation. In addition to cash flow consider the people flow, feed flow, air flow, manure flow, cow flow, equipment flow, milk flow, water flow as well as how it flows with the family.

**Cow Comfort is Priority Two!** Shortcomings in cow comfort can be a most costly mistake. Stalls are getting longer and wider for good reason. For optimum profit, a cow should be eating, drinking, milking or lying down chewing her cud. Milk quality also is often related to cow comfort.

**Dry Matter Intake is Priority Three!** Focus on proper feed bunk design, feed quality and type, lighting, ventilation and good quality and quantity of water. Each pound of dry matter intake above maintenance is worth 2 - 2.5 pounds of milk.

**Freestall barn design** impacts labor efficiency, cow comfort and dry matter intake. A curb height of 10" is recommended. Too high inhibits ease of entry and exit and increases teat injury. Too low increases manure in the stall. If using sand a 2x10 can be used to form the curb. If mattresses are used a 2x8 would give the proper height.

Stalls should be 46"-52" wide for lactating Holstein cows. For milking Holstein cows, 48" wide is recommended but up to 52" may be considered for large or pregnant dry cows. Nine feet of effective stall length is recommended on new construction. The minimum in renovations is 7.5' if the design allows proper lunging into an adjacent stall. Eight feet is more preferred. The freestall should slope to the back 3-4% (1-2 inches) which improves drainage and rising ability. Lateral slopes of 3% or greater tend to result in most cows laying in the same direction with their backbones uphill to prevent teat injuries. Cows have a difficult time getting up in freestalls sloped down to the front.

The brisket board should be installed at a minimum 66" from the back of the manure curb for mature Holstein cows but preferably 70" in new construction. Typically, the neck rail is mounted 44-50" above the bedded stall surface, directly above the brisket board. Do not use brisket boards higher than 4" above the stall surface. After cows are trained, adjust the neckrail back or forward according to observed behavior.

**Selecting Freestall Dividers** is full of options including side lunge, wide loop and straight loop. The loop should be designed to allow less than 12" of space between the end of the divider and the manure curb. If barns have different stall lengths, then different length stall dividers must be selected. Else, the incidence of cows backing into the neighboring stall increases.

Freestall dividers are not created equal. Stall dividers with a 32-38" opening are appropriate in that they allow the neckrail to be 44"-50" above the bedded surface and the bottom loop to be 9"-12" off the bedded surface.

**Fenceline Feedbunk Design** assists dry matter intake by allowing cows to eat in a grazing position. Bunks should be designed to allow a 19"-21" throat height and a neck rail 48" off the cow platform. The feeding platform should be 3"-6" higher than the cow platform.

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***Ventilation Is Imperative*** as it affects not only air quality which by itself is a major factor in dry matter intake but also affects herd health by decreasing the moisture (bacteria) load in the building. If the moisture cannot leave it can cause major heat stress problems in the summer and cause damp hair coats in late fall, winter and early spring and lessen a cow's insulation ability.

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In naturally ventilated buildings, the ridge opening should be 2" for every 10' of building width. On 6 row barns, the ridge opening should be 2.5"-3" per 10' of building width. The eave opening should be half the ridge opening on each side but preferably curtain side-walled for opening during summer.

If building new, 14-16' sidewalls are recommended. Barns should be orientated perpendicular to the most prevalent wind during the summer. So, summer winds normally come from the south so the barn should be built with an east-west orientation. This also reduces heat as the summer sun is directly above the barn but shining inside the barn in winter. North-south orientations are to be avoided if possible since the summer sun will shine into the freestall in both morning and afternoon along the length of the side creating a higher temperature inside. As a general rule, construct new barns 100 feet from any obstruction.

***Preventing Bird Problems*** in wooden framed barns has had limited success as it provides a place for birds to roost. Steel framed structures minimize the bird roosting problems and enhance the building's airflow and openness.

***Concrete Surfaces*** should be smooth yet have grooves to prevent slipping. Normally, concrete is grooved parallel to the manure alleys that allows water to flush barns and prevents scraper blades from catching. Grooves should be ½" wide and deep with a sharp edge. Cutting grooves after the concrete is poured and dried often results in cleaner grooves, although a bit more costly. If grooves are floated, make sure they have a distinct edge without abrasive places.

***Sand Versus Mattresses*** has been a common discussion point as time has proven these to be the most effective stall bases. An Iowa study conducted by Thoreson and Timms was designed to evaluate six different freestall surfaces. The study found that stalls ranked differently by week of trial, with cow preference switching between sand and mattresses. Sand

ranked highest in summer, but usage declined from summer to winter.

Wisconsin data from 1994 to 1998 compiled by Palmer showed no significant difference in milk production or somatic cell counts between sand or mattresses after an expansion. Producers using sand seemed more satisfied with cow comfort issues and less satisfied with manure management and bedding issues than those using mattresses.

Sand users reported significantly higher satisfaction scores for cow cleanliness and hock damage, whereas mattress users reported significant higher satisfaction with bedding use and cost and manure management. Culling rates, although not significantly different showed a slight numeric advantage to sand users.

Other research conducted in Europe demonstrated that cows showed definite preferences for some types of mattresses and that cows preferences changed over time. Reasons suggested is that cows need time to adjust to some types of mattresses and other mattresses get harder and less comfortable over time.

Currently, mattress-based freestalls are popular with a cost of \$50-\$100 per stall. Mattresses should provide animal traction, be waterproof and should be durable enough to withstand animal traffic. The expected useful life is 4 to 7 years.

Mattresses need some type of absorbent bedding applied to them. The initial cost of sand-based stalls is much lower. More labor is required to maintain sand and sand has adverse effects on manure handling and storage resulting in high maintenance costs. Some custom manure haulers refuse to haul sand-laden manure or charge extra for the service. Sand users using sand savers made of secured tires, rubber or plastic honeycomb webbing report cutting sand usage 40%-60%.

***Flexibility in New Facilities*** is best obtained with equal sized pens which can be subdivided into multiple pens with island waterers serving as the dividing points. By removing two gates an employee can change from housing two smaller groups to one large group.

***Manure Management*** and environmental regulations will continue to impact remodeling decisions. Manure management plans and deciding if skid steer or automatic scraping, flush

or slotted floors are most feasible are large investment decisions. Consult proper engineering assistance and consider future expansion plans. A manure pit can become too small too fast as a herd grows. And, when remodeling, it can also tend to tie a system down at a certain location and even limit future expansion. Design with flexibility in mind.

**One, Two, Three, Four, Five or Six Rows of Freestalls** have been designed successfully depending on the needs of the operator and present facility layout. If retrofitting freestalls into a present shed or barn, present dimensions may dictate design. Cow kennels (one row freestall with roof) are also an options moreso for cheap heifer, late lactation or dry cow housing, especially alongside cowyards or barns.

When building new, 3 row, 4 row and 6 row are most common. Five row freestall barns can also work where it is a 2 row design on one side for early lactation, higher producing cows and 3 rows on the other side for later lactation cows. The design of the roof on a five row is more of a challenge due to placement of the ridge opening.

When considering a 2 or 4 row versus a 3 or 6 row barn, compare cost estimates from builders and realize a 4 row can be overstocked up to 20% with no impact on production and producer perception of cow comfort. A 3 or 6 row barn, however, when stocked at 100% capacity is already stressing bunk space and feed alley space. Take these factors into account, along with ability to split pens when considering various designs.

**Headlocks or Cow Management Rails** are also common discussion points when remodeling or building new. Headlocks usually run about \$60 per headlock which needs to be compared to the cost of a separate treatment area, plus any labor savings over time.

Headlocks allow cows to eat while being treated in familiar surroundings with little time wasted. Headlocks can minimize “boss” cow syndrome at the feedbunk and decrease wasted feed. Manure from restrained animals is handled in the normal procedure.

Palpation rails on the other hand are much cheaper initially as cows are restrained in a herringbone fashion with minimal investment. Labor requirements, availability of feed and water, the effects of additional stress, plus handling of

manure necessitate that cows handled through a management rail need to be treated abruptly.

Research has shown no significant difference in cows eating from headlocks versus a post rail feeding system. If headlocks are used, slope the headlock top towards the feedbunk 3-4” to allow more room for the cows to reach for feed.

## **Remodel Facilities or Build New?**

Compare the initial and annual costs of remodeling and building new facilities. Quite often the costs to remodel are lower than building new. However, producers need to step back and ask, **“What constraints or compromises will cause higher annual costs even though initial building costs were lower?”**

- Will the facility cause an extra person to be needed daily for each milking due to a bottleneck in the holding area, parlor or with the feeding or manure handling system?
- Will cow comfort be sacrificed causing unclean cows that in turn cause another person to be needed for cow prep?
- Can herd health work through efficient cow management rails or other system be used so herd health doesn't suffer.
- Will the facility design impact cull rate and production level due to inadequate stall sizing, ventilation or feed access?
- Will the manure handling system be cost effective with the increased volume of manure?
- Is the parlor designed to optimize cow flow?
- Are the fixed costs (depreciation, interest, repairs, taxes and insurance) plus operating costs of the facility all taken into consideration?
- Does the present or alternative location affect not only costs but risks relative to environment, ventilation, feeding efficiency, neighbors, etc.

After all things are considered, building completely new may become more financially efficient in the long run. However, **it may not cash flow. And, just because it does cash flow is no guarantee that it is profitable** with adequate returns relative to the level of investment, management and risk one may assume in building a new or remodeled

facility. Many operations may remodel with a “terminal” operation in mind.

Thus, knowing your future goals, along with present and future production costs are a necessity for determining if remodeling, staying the same or building new is the better choice.

### **Remodeling Dairy Barns to a Parlor and Holding Area**

has made sense to many producers. With limited financial resources available, it is recommended to spend available resources on cow comfort, dry matter intake and labor efficiency priorities first. Typically, this means putting resources towards a well designed remodeled shed or new freestall barn as that’s where the cows spend most of their time.

Although many producers are very successfully converting tie stall barns into a parlor, not all tie stall barns make good remodeling projects. But, there are many advantages to consider this option.

- The milk house system is already in place adjacent to the remodeled parlor.
- Cost savings on the parlor could allow proper investment into the freestall facility.
- If designed correctly, cow flow and milking efficiency need not be sacrificed contrary to some opinions.
- Parlors in retrofitted barns have been built for under \$1,000 per stall without milking equipment included.
- Swing units can be employed initially by using present 2” line double-looped with 2% slope to incorporate a double eight to double ten parlor.
- Many stall barns are sized to handle a double 8 parlor with holding area for a 120 cow herd.
- The payback of a parlor in labor savings (time and back/knee bends) can be rapid if it saves an extra person milking.
- Labor savings could make a low cost parlor cost effective even if only used for several years in a transition phase.

Compare this option to staying with the present operation or building a new parlor. If a newer freestall is to be built, it is recommended that cows walk no further than 500 feet to be milked.

Consult ISU Publication LT-0601, The TRANS Iowa Milking Parlor Design and LT-0602, The Dairy Grazing Milking Center or UW-Extension’s Low-Cost Parlor Publication or CD for more information on low-cost dairy milking parlors .

### **Remodeling Barns to Heifer Housing**

can also be a good option if both parlor and freestalls are being built new. Size pens accordingly for small calves and group newly weaned calves (max 6-8 per pen) to reduce competition. Keep feed and water away from resting area or outside if possible. Consider labor, manure handling and feeding efficiency in the remodeled design and ventilate properly, especially for very young calves. Consult ISU Extension for heifer housing designs.

### **Remodeling Dairy Barns to Transition Cow Facilities**

can also be a good use for the space. Depending on herd size a portion of the barn could be made into freestalls to accommodate dry cows by simply removing the center alley. Cows in transition (2 weeks prior to calving) would have a separate freestall area allowing for separate feeding. Is it possible to open the east or south side of the barn to allow for drive by feeding? If not, consider the labor, manure handling and feeding efficiencies of transition cow facilities.

Another portion of the barn would then be close-up cow maternity pens designed in 12’ by 12’ dimensions. Allow one maternity pen for each 25 –30 cows and possibly a post-fresh pen.

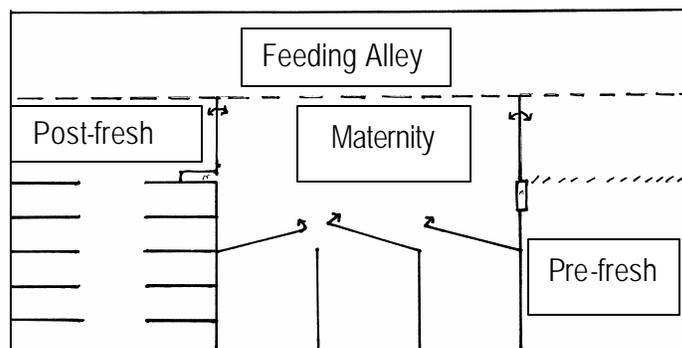


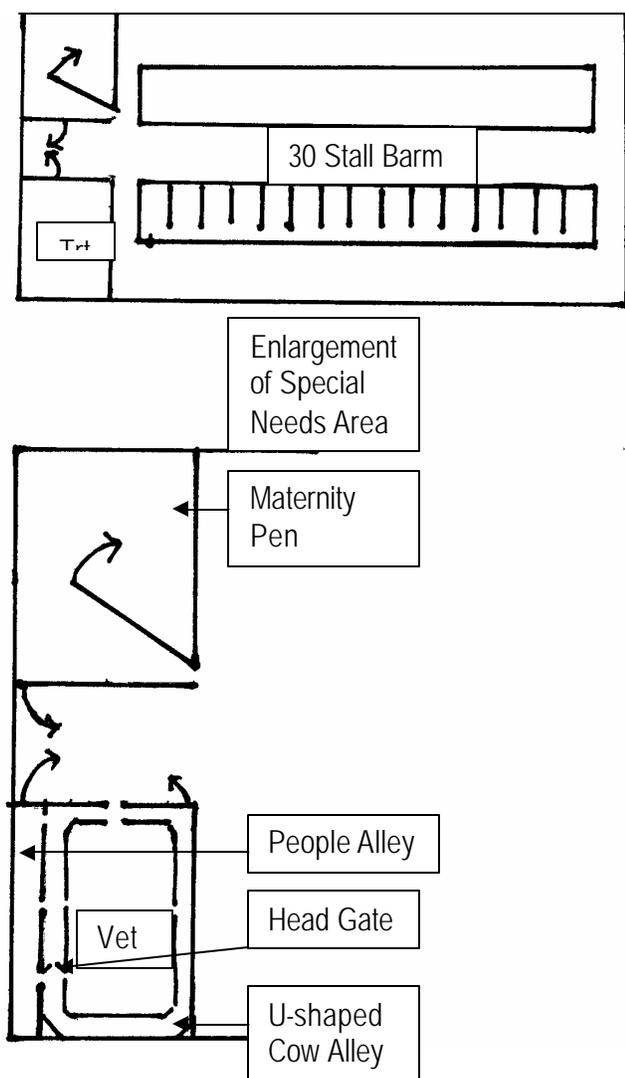
Diagram of possible Transition cow facility.

This is a 40 by 80-foot former stall barn. The Post-fresh area consists of 8 by 4 foot free stalls, an 8-foot alley and a 10-foot feeding alley. This could be increased to 12 or 14 foot by removing two free stalls. Maternity pens are 12 by 12 foot with an area to gather cows a few days ahead of calving. Pre-fresh could be large (48 inch wide) free stalls or a bedded pack. Sand should not be used in the maternity area, as cows will consume sand as they lick the calf dry. Either a post and rail or individual lockups could be used on the feeding

alley. If the topside faces south, it is possible to feed cows through the wall, thus increasing the capacity of the special needs barn. This diagram would accommodate a herd of 75 cows.

The current tunnel ventilation system could be left in place. The most frustrating problem with this layout may be working around existing support poles. More modern clear span buildings will work very good. A survey of Northeast Iowa dairy farms says that 65+ percent of farms have tie stall or stanchion barns for their cows. Developing a special needs area is found on the next page.

**Diagram of stall barn special needs area.**



One maternity pen can be converted to a special handling area or it can remain a treatment or Pre-calving area. The diagram shows "man passes" at strategic locations. These should be 14 inches wide.

A good example of a transition cow barn from a remodeled poultry barn is on the Terry Eick farm

near Readlyn. The three pictures give you an idea of how they did the remodeling.

**Transition Cow Space Needs** are dependent on the stage of transition the cow is in. For more information on transition cow management, consult the ISU Dairy Website at [www.extension.iastate.edu/dairy](http://www.extension.iastate.edu/dairy).

**Transition Cow Space Needs for Large Breeds.**

	Pen Size (Ft <sup>2</sup> )	Bunk Width (In)	Waterers
Pre-fresh	50 <sup>a</sup>	26-30	1/25 Hd.
Maternity	144 <sup>b</sup>	-	1/Pen
Post-fresh	Free Stalls <sup>c</sup>	24-28	1 per 30- 40 Head

<sup>a</sup> An additional 10 foot wide feed alley is needed.

<sup>b</sup> 10 by 14 foot or 12 by 12 foot.

<sup>c</sup> Free Stalls should be 48" inches wide and 66-72" inches from the curb to the <4" briskeet board

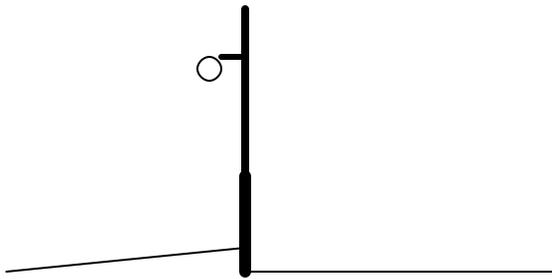


for Holstein transition cows.



## Freestall Housing Design Recommendations

Cows dry matter intakes are enhanced with fence line feeding systems. Thus, it is important to properly design the feeding system so as not to inhibit eating time or the cows ability to reach for feed. The illustration depicts recommendations:



Feed Alley

Cow Alley

### Dimensions for post and rail feed systems

Animal Size	Age (mo)	Throat ht.	Neck rail ht.
300-500 lbs	6-8	14"	28"
500-650 lbs	9-12	15.5"	30"
650-800 lbs	13-15	17"	34"
800-1200 lbs	>16	19"	42"
>1200	Cows	21"	48"

If headlocks are to be used, then the throat height curb should be lowered 3-4" to allow room for the bottom of the lock-up panel to not interfere with the cow's throat.

The final selection of freestall sizes depends on a balance of cow comfort versus maintenance of dirtier stalls. This balance is not as crucial on dairy heifers whose milk production performance is not as dependent on lying time relative to a lactating dairy cow. Longer stalls (9') give cows needed lunge room which will encourage cows to lay down more. Wider stalls (>48") might encourage cows to lay straighter in the stall.

Animal Size	Length	Width	Brisket Board
300-400 lbs.	48-54"	30"	36"
400-700 lbs.	60-72"	34"	48"
700-900 lbs.	72-78"	38"	52"
900-1100 lbs.	78-88"	42"	58"
1100-1300 lbs.	88-96"	46-48"	66"
1300-1700 lbs.	96-108"	48-54"	68-72"

Stall dimension recommendations are getting bigger as we learn more about cow comfort but also remember that cows, too, are getting bigger on average and so to build for the future, plan accordingly for cow sizes and thus, stall dimensions.

Below is a basic diagram for a three row freestall barn. A two row design with a fence line feeder would typically eliminate the outside row or one of the inside stall sets that are head to head. A four row design would simply mirror the two row design with a 16'-22' driveway width. A six row design would simply mirror the three row design.

If at all possible, freestall barns should run east to west to reduce heat load in the summer.

**The following dimensions are for Large Breed cows.** For smaller breeds, use the same dimensions on the facility except the freestalls can use the minimum for renovations recommendation.

- \* **FT = Feed Table width**; recommended range 3-4'; minimum for renovations = 2.5'
- \* **FA = Feed Alley width**; Recommended Range 12-14'; Minimum for renovations = 10'
- \* **SW = Stall Width**; Recommended Range 45"-52"
- \* **SLHH = Stall Length, Head-to-Head**; Range = 7-9'; Minimum for renovation = 7'
- \* **SLO = Stall Length, Outside wall**; Range 8-10'; Minimum for renovations = 7.5'
- \* **AW = Alley Width**; recommended range 8-10', minimum for renovations = 7'
- \* **SH = Sidewall Height** = recommended range 14-16'; minimum for renovations = 12'
- \* **CH = Curb Height**; recommended range 8-10"; minimum = 8", maximum = 12"
- \* **RS = Roof Slope**; recommended 3/12 – 4/12
- \* **DW = Driveway width**; recommended range 16-22' with feed tables included.

Ridge openings are necessary, even on monoslopes with front overhangs. At minimum, overhangs should cover feed tables in front and consider shading necessary in back for freestalls against the outside wall.

